REMARKS

Claims 1-12 and 15-20 remain in the application. Claims 15-20 are newly added, but do not add any new matter.

Applicant wishes to thank the Examiner for his suggestions regarding claim amendments to overcome the prior art. Applicant has incorporated the suggested amendments into Claim 1.

The present invention results from the discovery that by limiting portions of a composite image that is smoothed out, the image degradation of the composite image can be reduced. The field of display apparatuses is an extremely crowded field with consumers have an increasingly large number of choices when it comes to choosing which display apparatus to purchase. They therefore demand the latest and greatest features within the display apparatus. Thus, any improvement, no matter how minor, could be the crucial difference between commercial viability and failure.

> Thus when differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the decision-maker must consider the obviousness of the new structure in this light.

Continental Can Co. USA Inc. v. Monsanto Co., 20 U.S.P.Q. 2d. 1746, 1752 (Fed. Cir. 1991).

The present invention removes color drifts in an image while reducing image quality deterioration by reducing the accumulation of smooth-out effects. (Pg. 3, lns. 15-21). In the present invention, the color value storage unit 51 stores color values and α values of five sub-pixels comprising the target sub-pixel and the four sub-pixels adjacent the target sub-pixel. (Pg. 54, lns. 17-22). The dissimilarity level is calculated on a target sub-pixel and four sub-pixels adjacent the target sub-pixel. The filtering coefficient interpolating unit 75 determines a filtering coefficient for the target sub-pixel by performing a calculation on the initial values stored in the

initial filtering coefficient storage unit 75 in accordance with the dissimilarity level received from the largest color space distance selecting unit 53 and outputs the determined filtering coefficient to a luminance filtering unit 66 of the filtering unit 50. (Pg. 55, lns. 4-11). Then, the superimposing unit 41 calculates a color value of the corresponding target sub-pixel in the composite image from the color values of the front image output from the texture mapping unit 33 and the color values of the back image output from the back-image tripling unit 34. (Pg. 55, lns. 12-19).

The luminance filtering unit 66 calculates the luminance value of the target sub-pixel by performing a filtering process in accordance with the filtering coefficient received from the filtering coefficient interpolating unit 75. Luminance filtering unit 66 then outputs the post-filtering luminance values of the target sub-pixel to the RGB mapping unit 65. (Pg. 55, ln. 17 – Pg. 56, ln. 12).

Thus, the present invention removes color drifts from the composite images that are displayed for the first time by the semitransparent composition, but the back image that was subject to the smoothing out process in the previous semitransparent composition and displayed are not subject to being smoothed out again. This is especially beneficial for graphic drawing systems in which an image stored in a frame memory is displayed, the image is repeatedly subjected into the semitransparent compositions, and the frame memory is repeatedly overwritten. This is advantageous because it reduces the amount of filtering done to the back image and thus reduces image degradation.

The Office Action rejected Claims 1-4, 9, and 11 under 35 U.S.C. § 103(a) as being unpatentable over *Betrisey et al.* (U.S. 6,738,526) and *Hill* (U.S. 6,577,291).

Betrisey is directed towards displaying small sized text on LCDs by filtering the glyphs and utilizes two embodiments. In the first embodiment using post-cache filtering, the glyph display routine 824 has available the intermediate alpha values of the glyphs. To get the intermediate alpha values for the glyph, the glyph is sampled six times per pixel, or two times per sub-pixel as seen in Figures 9 and 10. (Col. 13, ln. 53 – Col. 14, ln. 9) The two values for each sub-pixel are then summed up to produce the intermediate alpha value for each sub-pixel in the glyph. Thus, the glyphs are represented by these intermediate alpha values which are concatenated prior to filtering. Therefore, by the time the filtering is performed, the intermediate alpha values located adjacent to glyph boundaries are defined and available for use during the filtering process. (Col. 14, ln. 28 – 38) This prevents color leakage across glyph boundaries. (Col. 15, lns. 5 – 12)

In the second embodiment using pre-cache filtering, the filter routine 813 first samples the glyph 6 times per pixel, or 2 times per sub-pixel as seen in Figure 14. (Col. 13, ln. 45 – 47; Col. 18, lns. 4 – 9, 49 - 52) The two values for each sub-pixel are then summed up to produce the intermediate alpha value for each sub-pixel in the glyph. (Col. 18, lns. 52 – 57). The glyph is then analyzed to determine if padding is necessary. The glyph is padded to add background alpha values along each pixel edge where color leakage will occur outside of the glyph as seen in Figure 15. (Col. 18, ln. 58 – Col. 19, ln. 3). Then each character glyph is filtered.

Betrisey, however, does not teach or suggest "a filtering unit smoothing out color values of second-target-range sub-pixels of the composite image that correspond to the first-target-range sub-pixels, by assigning weights, which are determined in accordance with the dissimilarity level, to the second-target-range sub-pixels, and to overwrite the color values stored in the frame memory with color values of the composite image after smoothing out." The Office Action

admits that *Betrisey* does not teach a filtering unit smoothing out color values of second-target-range sub-pixels of the composite image that correspond to the first-target-range sub-pixels. *Betrisey* relates only to semitransparent compositions and does not disclose smoothing out in brightness or that the smoothing out is determined based on the dissimilarity level in the front image. Also, *Betrisey* does not disclose overwriting the color values stored in the frame memory with color values of the composite image after smoothing out.

Betrisey also does not teach or suggest "a displaying unit displaying an image based on the color values of the composite image after the smoothing out stored in the frame memory, wherein in the smoothing out by the filtering unit, assignment of a larger weight causes a greater degradation of image, and when the front image storage unit stores color values of a plurality of front images and when the superimposing unit is to generate color values of another composite image using color values of another front image among the plurality of front images, the superimposing unit uses the color values stored in the frame memory after the overwriting by the filtering unit, as color values of a back image." The Office Action cited to Column 28, lines 23-25 for displaying images that have been smoothed out. However, *Betrisey* only discloses that the gamma correction should be performed on the composite image. *Betrisey* does not disclose that characteristics of the front image should be taken into account before filtering the composite image to prevent image degradation. Furthermore, *Betrisey* also does not disclose that the color values from the frame memory is used as the back image after the overwriting by the filtering unit.

Hill is directed towards reducing aliasing associated with displaying relatively low resolution representations of text by exploiting the different intensity contributions by the red pixel, the green pixel, and the blue pixel to the human eye through a weighted scan conversion.

(Col. 4, lns. 40-60; Col. 17, ln. 29 – Col. 18, ln. 5). However, after this weighted scan conversion is completed, the pixel color processing sub-routine 970 in Figure 9C or sub-routine 990 in 9D are used to determine if the luminous intensity values of the CURRENT PIXEL should be adjusted to reduce or eliminate color artifacts and to make such adjustments as required. (Col. 20 lns. 40-45). In sub-routine 970 displayed in Figure 9C, the CURRENT PIXEL is analyzed, independent of the luminous intensity of the foreground and background colors. (Col. 21, lns 16-18). In sub-routine 990 displayed on Figure 9D, the R, G, and B luminous intensity values of the CURRENT PIXEL is compared with the foreground color and the background color. If the difference is greater than a pre-selected acceptable range, the color of the CURRENT PIXEL is adjusted towards the range of acceptable colors. (Col. 24, 5 – 14) This may involve modifying one or more of the red, blue, or green sub-pixels.

Hill does not teach or suggest "a filtering unit smoothing out color values of second-target-range sub-pixels of the composite image that correspond to the first-target-range sub-pixels, by assigning weights, which are determined in accordance with the dissimilarity level, to the second-target-range sub-pixels, and to overwrite the color values stored in the frame memory with color values of the composite image after smoothing out." In *Hill*, the CURRENT PIXEL is analyzed, independent of the luminous intensity of the foreground and background colors. (Col. 21, lns 16-18). Thus, although a comparison of the foreground and background color may reveal the necessity for color adjustments, the actual color adjustment process only analyzes the CURRENT_PIXEL. Furthermore, *Hill* does not disclose overwriting the color values stored in the frame memory with color values of the composite image after smoothing out. *Hill* only teaches editing the CURRENT_PIXEL and there is no mention of using the CURRENT_PIXEL as the subsequent back image.

In contrast, the present invention calculates the dissimilarity level based on the target sub-pixel and its adjacent sub-pixel in the front image. (Pg. 54, ln. 23 – Pg. 55, ln. 4). It then calculates a filtering coefficient based on the dissimilarity level of the target sub-pixel and its adjacent sub-pixel in the front image to filter the target sub-pixel corresponding to the composite image. (Pg. 55, lns. 4-11; lns. 20-26; Pg. 56, lns. 1-12). Furthermore, the color values in the composite image are written over the color values stored in frame memory 2. (Pg. 46, lns. 10 – 11).

Hill also does not disclose "a displaying unit displaying an image based on the color values of the composite image after the smoothing out stored in the frame memory, wherein in the smoothing out by the filtering unit, assignment of a larger weight causes a greater degradation of image, and when the front image storage unit stores color values of a plurality of front images and when the superimposing unit is to generate color values of another composite image using color values of another front image among the plurality of front images, the superimposing unit uses the color values stored in the frame memory after the overwriting by the filtering unit, as color values of a back image." There is no teaching in *Hill* that assignment of a larger weight by the filtering unit causes a greater degradation of the image where the weight is based on the dissimilarity level based on the acquired color levels between the target sub-pixel and the one or more adjacent sub-pixels. *Hill* only discloses that the color of the CURREN_PIXEL could be adjusted, but makes no mention of any detrimental effect such adjustments may have.

In contrast, the present invention the filtering unit assigns a larger weight for larger dissimilarity levels and a smaller weight for smaller dissimilarity levels. If there is a larger weight, there will be more smoothing out of the pixel in the composite image. However, if there

is a smaller weight, there will be less smoothing out of the pixel in the composite image. Thus, if there is a small dissimilarity level, there is a small smoothing out and if there is a large dissimilarity level, there is a large smoothing out. Since smoothing out reduces the image quality, the amount of smoothing out applied to each pixel can be appropriately varied from pixel to pixel in the composite image. Thus, portions of the composite image that came from the back image, which has already been smoothed out and thus has a low dissimilarity level, need not be smoothed out again. This prevents the image degradation of the back image.

Also, there is no indication that *Hill* teaches that the superimposing unit should use the color values stored in the frame memory, which is the composite image that has been smoothed out, as the back image when there is a need to generate another composite image.

In contrast, in the present invention, the color values in the composite image are written over the color values stored in frame memory 2. Then the process is repeated with the composite image that was written over the color values stored in frame memory 2 serving as a new back image. (Pg. 43, lns. 4 – 9; Pg. 46, lns. 10 – 11). Thus, the present invention can reduce image degradation for images that are subject to repeated filtering.

With respect to Claims 9 and 11, all arguments for patentability with respect to Claim 1 are repeated and incorporated herein.

The Office Action rejected Claims 5-8, 10, and 12 under 35 U.S.C. § 103(a) as being unpatentable over *Betrisey* in view of *Hill* and *McCormack et al.* (U.S. Patent App. No. 2002/0097241).

McCormack is directed towards reducing memory and processing bandwith requirements of a computer graphics system by using a buffer in a graphics pipeline to merge selected image fragments before they reach a frame buffer. (¶ 0002).

With respect to Claim 5, the Office Action admits that *Betrisey* and *Hill* fail to recite, "a calculation unit acquiring color values and transparency values of first-target-range sub-pixels that constitute a front image and are composed of a target sub-pixel and one or more adjacent sub-pixels that are adjacent to the target sub-pixel in the lengthwise direction of the pixel rows, and to calculate a dissimilarity level of the target sub-pixel to the one or more sub-pixels from the acquired color values and transparency values."

However, *McCormack* also fails to disclose "a calculation unit acquiring color values and transparency values of first-target-range sub-pixels that constitute a front image and are composed of a target sub-pixel and one or more adjacent sub-pixels that are adjacent to the target sub-pixel in the lengthwise direction of the pixel rows, and to calculate a dissimilarity level of the target sub-pixel to the one or more sub-pixels from the acquired color values and transparency values." *McCormack* teaches that the absolute value of the difference between the color value for one fragment and the color value for the other fragment can be used to determine if the two fragments are sufficiently similar for merging. However, the difference between two color values of two fragments is not the same as the transparency value. The transparency in the present invention is between 0 and 1. If a pixel has an alpha value of "0" it is completely transparent and if it has an alpha value of "1" it is non-transparent. (Pg. 21, lns. 7 – 19). Thus, the transparency is how strong the display of the pixel is and not what color the pixel is. Therefore, the transparency of a pixel is different from the color value the actual pixel possesses. Furthermore, *McCormack* teaches that the absolute value of the difference is used to determine if the two fragments are sufficiently similar for merging. In contrast, the present invention teaches using the transparency value to determine how much the filtering should be done to the composite image.

With respect to Claims 10 and 12, all arguments for patentability with respect to Claim 5 are repeated and incorporated herein.

Dependent Claims 2-4 and 6-8 depend from and further define Claims 1 and 5 and are thus patentable, too.

The application is believed in condition for allowance. If there are any questions with regards to this response, the undersigned attorney can be contacted at the listed phone number.

Very truly yours,

SNELL & WILMER L.L.P.

Joseph W. Price
Registration No. 25,124
600 Anton Boulevard, Suite 1400
Costa Mesa, California 92626-7689
Telephone: (714) 427-7420
Facsimile: (714) 427-7799